

### **Discussion of Anomaly in Borehole 52-03-06**

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Borehole 52-03-06 (299-W10-96) is located in the 241-TY tank farm, approximately half way between tanks TY-105 to the south and TY-103 to the north. The borehole was drilled in 1971 to a total depth of 100 ft. The casing is 6-inch diameter (nominal) schedule-40 steel pipe (0.280 in. wall thickness).

Both tanks have been declared leakers: TY-105 in 1960, with an estimated volume of 35,000 gallons and TY-103 in 1973, with an estimated volume of 3,000 gallons. (Hanlon, Feb 28, 2002). Both tanks were interim stabilized in 1983. Inventory values for the tanks as reported in Hanlon (Feb 28, 2002) are:

Tank	Total Waste	Supernatant Liquid	Drainable Interstitial Liquid	Drainable Liquid Remaining	Pumpable Liquid Remaining	Sludge	Saltcake
TY-103	155	0	23	23	19	103	52
TY-105	231	0	12	12	10	231	0

All volumes are in Kgal

Borehole 52-03-06 was logged with the SGLS on April 30, 1996.  $^{137}\text{Cs}$  and  $^{60}\text{Co}$  were detected.  $^{137}\text{Cs}$  was measured continuously from ground surface to 5 ft depth, and intermittently from 8.5 to 14.5 ft and 56 to 61 ft. The maximum concentration was about 1.5 pCi/g at ground surface. At 56 ft, a concentration of 1.12 pCi/g was measured.  $^{60}\text{Co}$  was detected continuously from 54 to 100 ft (total log depth), with a maximum concentration of 36.8 pCi/g at 99.5 ft. Results of shape factor analysis of the  $^{60}\text{Co}$  peaks indicate that the contamination probably migrated through the formation rather than along the casing.

Evaluation of historical gross gamma data show an increase in gamma activity over time in the deeper portions of the vadose zone. Evaluation of historical gross gamma data by Three Rivers Scientific identified contamination from 44 to 98 ft as "unstable." "The grade thickness product for this interval showed a slow continued increase from 1975 to 1978. From 1978 to 1985 the rate of increase is slower, and from 1985 to 1994 the decrease in grade thickness product is faster than can be explained from decay of  $^{60}\text{Co}$ ." (R.R. Randall, HNF-3831, Oct, 1999)

Intersection of a known contaminant plume, location between two tanks previously declared to be leaking, and the presence of drainable liquid in both tanks led to assignment of a relatively high monitoring priority for borehole 52-03-06. On May 2, 2002, the interval from 40 to 100 ft in borehole 52-03-06 was logged with the RAS (large detector). Initial review of the data detected a prominent peak at 55 to 57 ft that was not consistent with the 1996 SGLS log. Review of RAS spectra indicated the dominant contaminant in this region to be  $^{137}\text{Cs}$ . Preliminary comparison of the RAS data with the baseline SGLS data indicate that the discrepancy between 55 and 57 ft appears to represent an influx of  $^{137}\text{Cs}$ . Therefore, the decision was made to re-log the borehole with the SGLS as soon as possible. Additional SGLS data can be compared with the baseline to confirm the presence of an anomaly, and to estimate the magnitude of  $^{137}\text{Cs}$  at 55 to 57 ft depth. In accordance with our project procedures, Rob Yasek (DOE-ORP) and Dave Barnes (CHG-

Tank Farms Data Evaluation) were verbally informed of the above on Friday afternoon, May 3, 2002

The interval from 45 to 100 ft in borehole 52-03-06 was re-logged by the SGLS on May 9, 2002. Preliminary log plots are attached. The 1996 SGLS data were reprocessed with the current casing correction function to eliminate any difference in calculated concentrations associated with variations in data processing methods over six years. Finally,  $^{60}\text{Co}$  values from the 1996 SGLS data were decayed to 2002 (both actual and decayed values are shown on the plots). Preliminary evaluation of the SGLS data indicates a  $^{137}\text{Cs}$  anomaly from 55 to 60.5 ft, with a maximum  $^{137}\text{Cs}$  concentration of 48.2 pCi/g at 56 ft. This compares to a recalculated  $^{137}\text{Cs}$  value of 1.18 pCi/g at 56 ft in the 1996 data. Also, it appears that the  $^{60}\text{Co}$  concentration is decreasing at a rate greater than that which can be accounted for by radioactive decay. From 54 to 70 ft  $^{60}\text{Co}$  values in the 2002 data are close to predicted values based on decay of the 1996 data. From 70 to 80 ft, 2002 values are less than half the predicted value, and below approximately 80 ft, 2002  $^{60}\text{Co}$  values are less than one fourth of the expected value.

The preliminary interpretation of the log data for 52-03-06 provides the following findings:

- There is a greater than forty-fold increase in  $^{137}\text{Cs}$  at 55 to 60.5 ft, with a maximum value at 56 ft, which suggests the appearance of a “new” contaminant plume.
- The measured levels of  $^{60}\text{Co}$  between 54 and 65 ft appear to be decreasing at a rate commensurate with radioactive decay. From 65 ft to 100 ft (total depth)  $^{60}\text{Co}$  concentration appears to be declining at a rate 2 to 4 times greater than can be explained by radioactive decay.
- Preliminary comparison of KUT plots for the two SGLS data sets show a very similar profile. The consistency in KUT values between 1996 and 2002 confirms the long-term performance of the SGLS logging systems and indicates that the observed variations in man-made radionuclides represent legitimate variations in contaminant levels and not instrument error. The most notable contact on the KUT plots is the base of the tank farm excavation at about 45 ft depth. Increases in  $^{238}\text{U}$  and  $^{232}\text{Th}$  near the bottom of the borehole may indicate a transition between the basal Hanford formation and the early Palouse/Plio-Pleistocene unit at about 93 ft. The lithology log shows a change from medium sand to silt at this depth.





